

Kennecott
10 East South Temple
P.O. Box 11248
Salt Lake City, Utah 84147
(801) 322-8261

Gregory H. Boyce
Director, Environmental Affairs

Kennecott

June 12, 1986

Mr. Calvin Sudweeks
Director, Bureau of Water Pollution Control
Utah Division of Environmental Health
P. O. Box 45500
Salt Lake City, Utah 84145

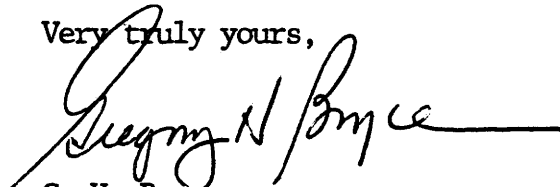
RECEIVED
SEP 09 1986
DIVISION OF
OIL, GAS & MINING

Dear Mr. Sudweeks:

SUBJECT: Utah Copper Division Modernization Project

Enclosed for your review and approval is our response to Mr. B. O. Elwell's information request of April 28, 1986. Included in this package is a summarized permit application and an analysis demonstrating no impact to groundwater resources in the unlikely event of a pipeline failure. Because Kennecott is anxious to finalize project approval, we would appreciate any efforts you can make toward expediting review and approval.

Very truly yours,


G. H. Boyce

/mf
Enclosure

cc: R. R. Dimock, w/o enc.
L. K. Jacobson, w/o enc.
V. R. Rao, w/o enc.
S. D. Taylor, w/o enc.
A. M. Trbovich, w/o enc. ✓
J. B. Winter, w/o enc.

0033

SUMMARIZED PERMIT APPLICATION PACKAGE
UTAH COPPER DIVISION MODERNIZATION PROJECT
GRINDING PLANT AND PIPELINE CORRIDOR

Introduction and General Information

In late 1984, Kennecott applied to the Utah Bureau of Water Pollution Control for a permit to construct water control facilities associated with an ore processing plant to be located approximately one mile north of Copperton. These facilities include a 7.5 million gallon process water reservoir, a slurry (flotation feed) pipeline, a return process water pipeline, and stormwater retention reservoirs. Since the initial submission, additional information has been presented to the Bureau on September 10, 1985, December 2, 1985 and February 12, 1986. Several verbal discussions were also conducted between Bureau and Kennecott personnel. The aim of the supplemental submissions was to update the Bureau on changes to the project scope, respond to Bureau concerns regarding specific aspects of the project and assure the Bureau of the environmental soundness of the project design.

Because of the large volume of information included in the supplemental submissions, the Bureau has requested the preparation of a summarized permit application package. This package consolidates the information previously presented to the Bureau. A limited amount of new information regarding the process water reservoir lining and the potential impact of a pipeline break is also presented.

Scope Summary

The new Copperton grinding facility will be designed to process a nominal 77,000 dry st/d of ore, to produce a 30 percent solids flotation feed slurry which will be transported by gravity pipeline to the existing Magna and Arthur concentrator flotation circuits.

The Project includes the following facilities:

- o Coarse ore stockpile "A frame" structure supporting the ore feed and stockpile shuttle conveyors. The total stockpile capacity will be 348,000 st.
- o Coarse ore reclaim system. Three tunnels each with four apron feeders, and three 54 in. conveyors will feed ore to three grinding lines. The coarse ore stockpile live capacity will be 45,000 st.
- o Grinding. The facility will include three lines of grinding equipment. Each line will include a semi-autogenous mill, two ball mills, cyclones, screens, sumps, pumps and other related material handling equipment. The grinding process equipment will be housed in a grinding building with overhead cranes. The

building will contain electrical and control rooms, computer room, instrument and electrical repair rooms and offices, lunch room, sanitary facilities, and sample preparation area.

- o Slurry (flotation feed) pipeline system. Gravity 48 in. slurry pipeline to splitter box near Magna, feeding a 42 in. Magna branch and a 36 in. Arthur branch.

Approximate lengths - Copperton to Splitter - 48 in. - 68,000 ft
Splitter to Magna - 42 in. - 2,200 ft
Splitter to Arthur tie - 36 in. - 3,000 ft

System includes pipe bridges across Barney's Wash and railroad tracks and approximately 32 drop boxes.

- o Process Water Pipeline System. Pumping and pipeline system from Magna reservoir to a new Copperton reservoir, consisting of pump Station 3A near Magna, Booster Pump Station 3B and a 62,000 ft long, 48 in. pipeline. Each pump station will have seven 6,400 gpm pumps (six operation + one spare), an electrical substation, and a feeder from the existing Kennecott 44 kv transmission lines.
- o Common pipeline corridor for the slurry (flotation feed) and process water pipelines. The corridor width will vary from 25 to 45 ft and be 65,000 ft long.
- o Fresh water pipeline system. Pump station and 16,000 ft of 16 in. pipeline from the Salt Lake County Water Conservancy tank on Road South 10,200 ft to the new Copperton grinding facility. The pump station will have 3 - 1,500 gpm pumps (two operating + one spare), and an electrical substation and tie to an existing nearby UP&L overhead 44kv transmission line.
- o Lime Plant. Plant will include two lime silos, a milk of lime slurry preparation plant and two slurry holding tanks. A burner oil reagent storage tank and distribution system will be included next to the lime plant facility.
- o Change and Guard House. The change house will contain lockers, showers and toilets for the work force. It will be a single story facility.
- o Miscellaneous.
 - Equipment garage, eight bay, steel frame building, 7,200 sf.
 - Oxygen - acetylene bldg., 800 sf steel frame building with loading dock on one side.
 - Truck Scale - 75 ton capacity.
- o Site development and utilities for new Copperton site. Includes grading, drainage, three retention ponds, a 7.5 million gallon

process water reservoir, fresh water tank; and process and utilities piping. Space will be provided for future addition of flotation, molybdenum plant and tailings thickeners.

- o Yard Electrical - 13.8kv plant substation (adjacent to UP&L 138kv substation); plant feeders, yard lighting, grounding yard distribution, ductbanks, and telemetering to offsite facilities.
- o Plant Roads A 1.7 mile main access road, plus in-plant roads and parking.

Project Drawings

The listed drawings describing the project are included:

- o Exhibit A - Drainage Report Area Plan
- o Exhibit B - Concentrator Site Drainage Plan
- o Exhibit G - Septic Tank and Absorption Field
- o Exhibit H - Flotation Feed System Pipeline Profile
- o Exhibit I - Flotation Feed System Drainage Area Plan
- o Exhibit J - Pipeline Corridor - Typical Earthwork Details
- o Exhibit K - Pipeline Corridor - Typical Drainage Details
- o Exhibit N - Zone I Retention Pond Plan
- o Exhibit O - Zone I Retention Pond Sections
- o Exhibit P - Zone II Retention Pond Plan
- o Exhibit Q - Zone II Retention Pond Sections
- o Exhibit R - Zone III Retention Pond Plan
- o Exhibit S - Zone III Retention Pond Section
- o Exhibit T - 7.5 Million Gallon Process Water Reservoir
- o Exhibit U - Process Water Reservoir Sections and Details
- o Exhibit V - Flotation Feed System Pipeline Drop Box Details
- o Exhibit W - Burner Oil Storage
- o Exhibit X - Process Water Reservoir Liner Detail

Plant Site Retention Ponds and Process Water Reservoir

Runoff from precipitation falling directly on the plant site will be captured in one of three clay-lined retention ponds (Exhibit B). These ponds, which will have a permeability of 10^{-6} cm/sec, will have the capacity to contain a 10 year 24 hour storm event. (See "Hydrological and Hydraulic Design Report For Retention Pond For UCD Modernization Project - Grinding Plant," enclosed.) The collected water will be removed from the ponds by pumping into the process water system. The reclaimed water will flow with the ore slurry to the flotation facilities at the Magna and Arthur plants and into the existing tailings pond. Under Part I, Section A, Clause 3 of Utah Copper Division's existing NPDES permit, a discharge exemption for precipitation snow melt runoff is allowed if the tailings pond volume and associated clarification channel have a total pool volume of 380 acre-feet. Kennecott is diligent in maintaining this available volume.

The retention pond liners will be constructed of locally available clay materials. Two proof tests for liner permeability will be conducted on each retention pond. A qualified engineer will supervise the pond liner construction and will determine the frequency of compaction testing.

No runoff will flow into the process water reservoir. However, the reservoir will be equipped with a spillway to meet the Utah dam safety regulations. The spillway will direct overflow into Barney's Wash. Because overflow is very unlikely, no facilities are included to capture or recover released water. Overflow is unlikely because water is pumped under control into the reservoir and flows by gravity to the grinding plant. There is no inlet gravity flow. Thus, during power failure or other malfunction which interrupts flow, water does not continue to enter the reservoir. The reservoir will be equipped with a high level detector which will automatically turn-off the inflow pumps and alert the grinding plant operator. The installed instrumentation will assure that no overflow occurs.

The process water reservoir will be double-lined to prevent water escape (Exhibit X). A leak detection and collection system will be placed between the two liners. The upper liner will be 36 mil reinforced chlorinated polyethylene. The leak capture system will be gravel and will be sloped to direct water into a six inch perforated pipe. The lower liner will be compacted local clay. Water captured by the leak system will be returned to the process water reservoir.

Runoff from precipitation falling off the plant site will be directed around the site.

Plant Site Groundwater

Two culinary wells owned and operated by the Copperton Water Improvement District are located in Barney's Canyon, approximately one-third mile northeast of the eastern tailings thickeners. These two wells are designated W-31 and W-32 in "Geologic, Ground and Surface Water Data Background and Progress Report of Kennecott's Utah Copper Division (UCD)

Mine Hydrogeologic Study." When constructed, the depth to water in W-31 was 139 feet. The well is 1,274 feet deep and is perforated from 149 feet to 1,218 feet.

An abandoned and filled monitor well, K-81, is located on the southwest corner of the concentrator site. When drilled, the depth to water in this well was 127 feet. Additional information about the relevant wells may be found in the cited document, which is in the Bureau's possession.

Thirty-six bore holes up to approximately 100 feet deep were drilled at the concentrator site area as part of the site soil study. Except for a very small perched aquifer 35 feet below the tailings thickeners, no free groundwater was encountered.

Two new monitor wells, one shallow and one deep, will be placed downgradient of the grinding plant site and upgradient of the Copperton wells. The hydrogeology of the area will be defined and utilized to select the specific well location and depths.

Pipeline Corridor

The pipeline corridor will be constructed of cut and fill material and will pass through numerous drainages between the grinding plant and the Magna and Arthur plants. The entire facility is designed to pass a 100 year 24 hour storm event runoff. The Salt Lake County Flood Control Division has reviewed the project and has issued a Flood Control Permit.

The normal operating condition for the 48 inch (inside diameter) ore slurry pipeline will be a flow of 38,000 gallons per minute. The pipeline will lay on a 0.008 slope (continuous downgrade). The slurry will normally flow at 13.5 feet/second and will half-fill the pipe. During operations, the pipeline will contain 3.3 million gallons of material. Approximately 90 minutes will be required for slurry entering the pipeline at the grinding plant to reach the Magna and Arthur concentrators. The ground ore slurry will contain approximately 30 percent solids. The pipeline will be installed essentially above grade and bedded to one-third depth to provide stability against movement. Approximately 6000 feet of pipeline through the area Hercules has leased from Kennecott near Baccus will be buried with a minimum three feet cover. A private 10 foot wide gravel maintenance and inspection road will parallel the pipeline. Public traffic will not be permitted on this road. The property owned by Kennecott is fenced and protected by gates. Inspection of the entire pipeline will be performed daily.

The pipe is a heavy wall (5 inch thick) concrete pipe with flexible gasketed joints at 8 to 24 foot intervals. As mentioned, the pipe will be partially bedded (Figure 1). The weight of the pipe (1000 pounds/foot) and the bedding procedure restricts pipe movement which otherwise might damage the joint seals.

High quality rubber gaskets and low internal pressure will prevent joint leakage. The inside of all joints will also be filled with sealant to prevent fine solids collection and to aid in leak prevention.

The pipeline will tolerate ground movement due to seismic events or settlement in the lateral, vertical and longitudinal directions. The flexible joints permit the pipe to follow the ground movement without creating high stresses. The entire pipeline, including the drop box structures, will be designed to UBC Zone 3 seismic specifications.

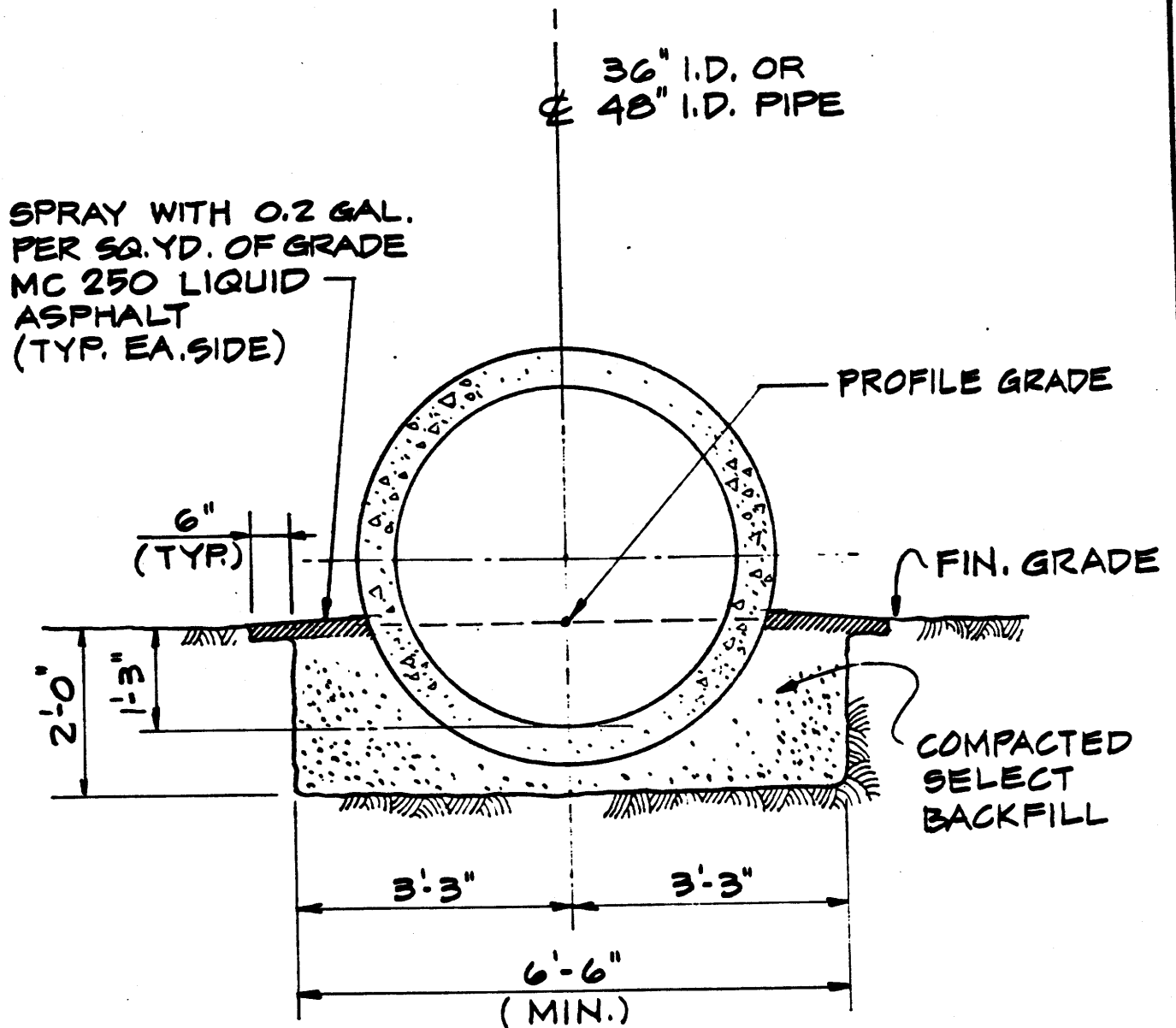
Kennecott did have Dames and Moore investigate the potential groundwater impacts of an unlikely pipeline failure. In the report ("Ground Water Impacts of Pipeline Failure, Proposed Ore Slurry Pipeline" enclosed) Dames and Moore concludes that a pipeline failure would have negligible impact on groundwater. The cost of a pipeline failure containment system would be approximately \$8 million.

Kennecott has operated a similar gravity flow slurry pipeline from the Bonneville concentrator to the Magna and Arthur concentrators since the mid-1960s. No failures have occurred along this pipeline.

Based on the above analysis, Kennecott has no plans to construct a pipeline failure containment system.

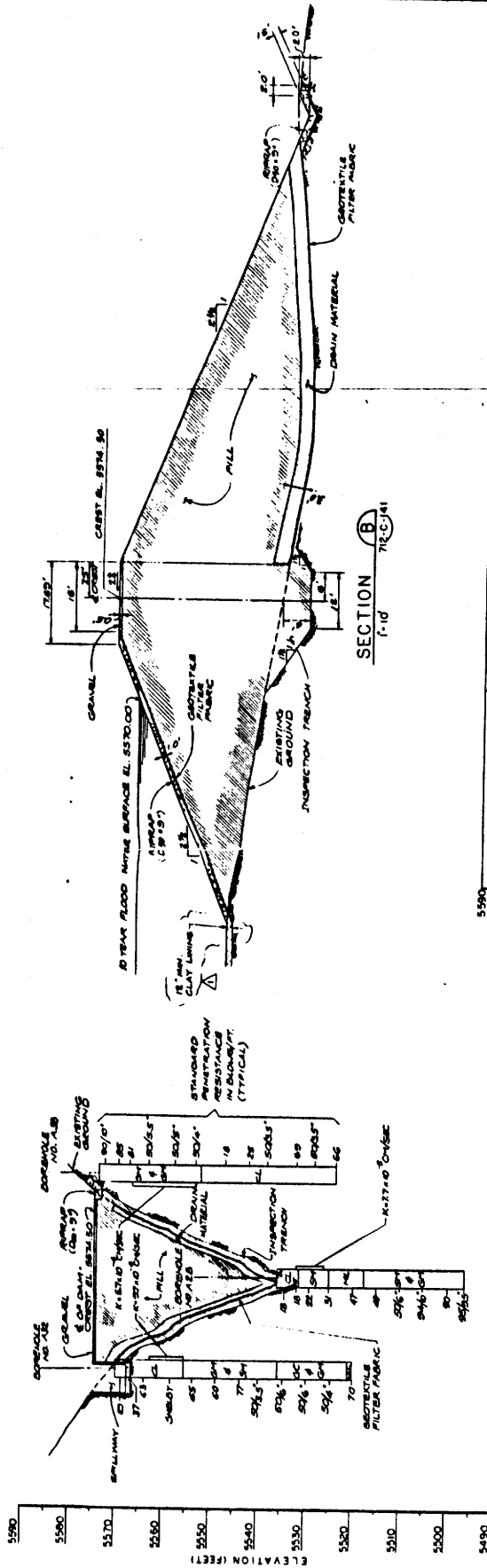
This drawing and the design it covers are the property of BECHTEL. They are hereby loaned and on the borrower's express agreement that they will not be reproduced, copied, loaned, exhibited, or used except in the limited way and private use permitted by any written consent given by the lender to the borrower.

Figure 1

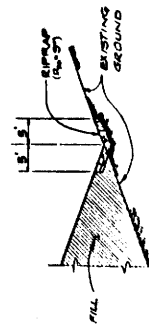


		2/4/86	ISSUED FOR INFORMATION		PMS					
No.	DATE	REVISIONS			BY	CHK'D	DESIGN SUPV	ENG R	PROJ ENGR	APPR
SCALE		DESIGNED		DRAWN P SECRETARIO		CHIEF ENGR				
ORIGIN		UCD CONCENTRATOR MODERNIZATION				JOB No. 17594				
BCMI		FLOTATION FEED LINE				DRAWING No.		REV.		
		PIPE BEDDING DETAIL				410-SKC-113		A		

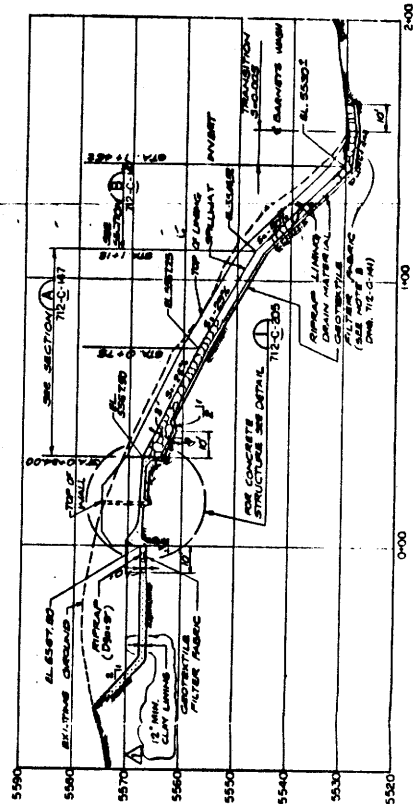
11-1 SEE



DAM PROFILE - SECTION A
HOR. 1:40
VERT. 1:10
N.T.S. 712-C-141



SECTION C
N.T.S. 712-C-141



SPILLWAY PROFILE
HOR. 1:20
VERT. 1:10



EXHIBIT 0

KENNECOTT									
BECHTEL CIVIL & MINERALS, INC. SAN FRANCISCO									
UCD CONCENTRATOR MODERNIZATION CONCENTRATOR SITE ZONE 1 RETENTION POND SECTIONS									
GENERAL		DATE		SCALE AS NOTED		DATE			
				HORIZ. 1" = 10'		VERT. 1" = 10'			
				PLAN		SECTION			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'		1" = 10'			
				1" = 10'</					

1 FOR GENERAL NOTES AND REFERENCE CHANGES SEE SHEET 712-C-145.		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41																																																																																																																							

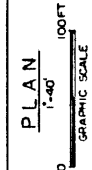
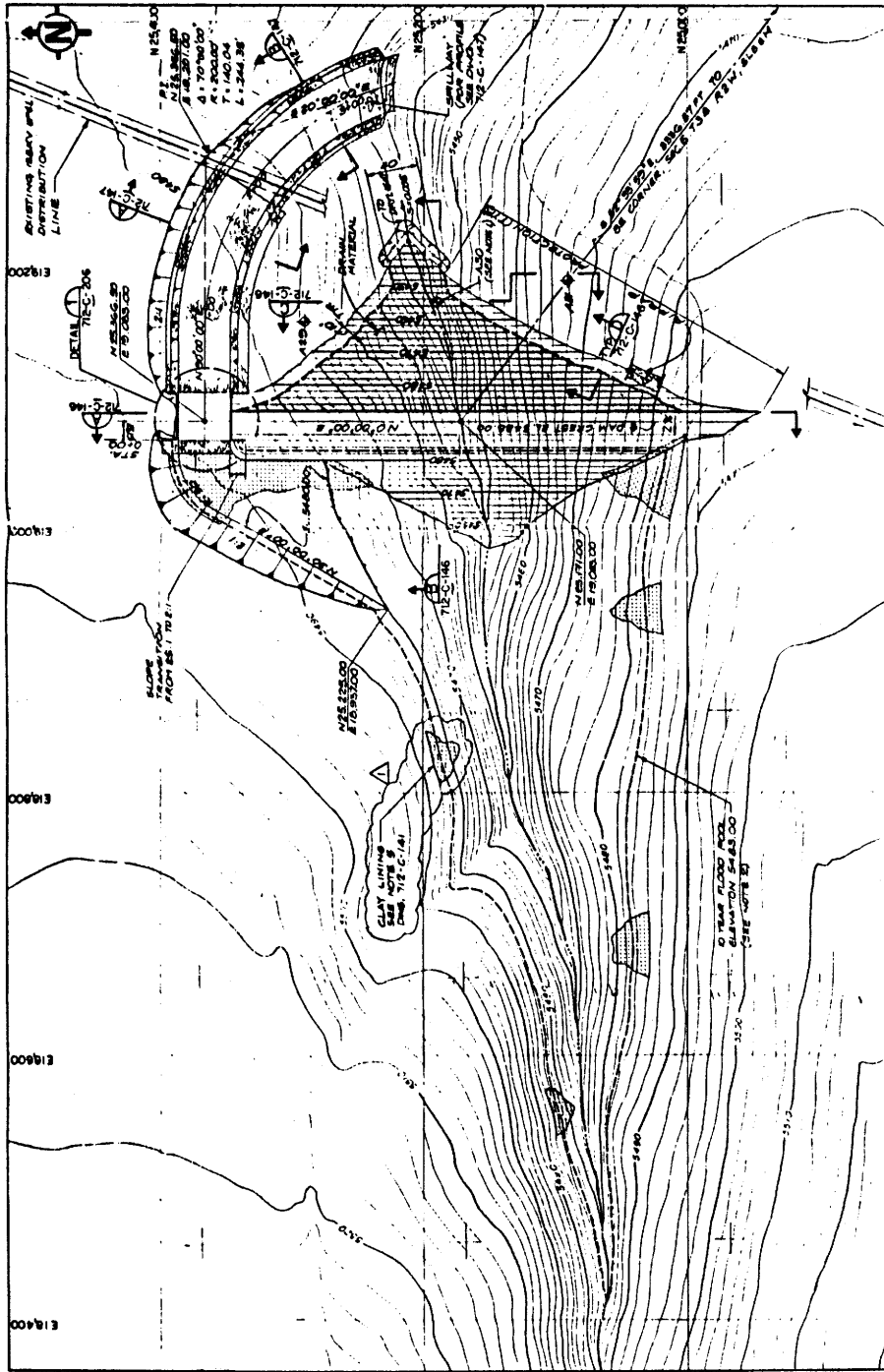
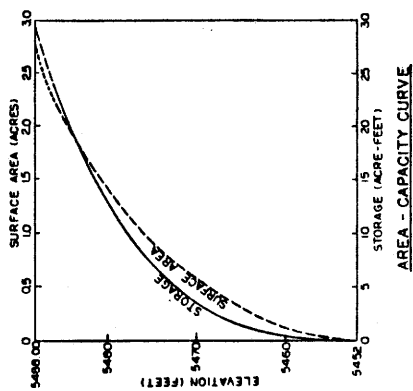


EXHIBIT 36

[illegible]

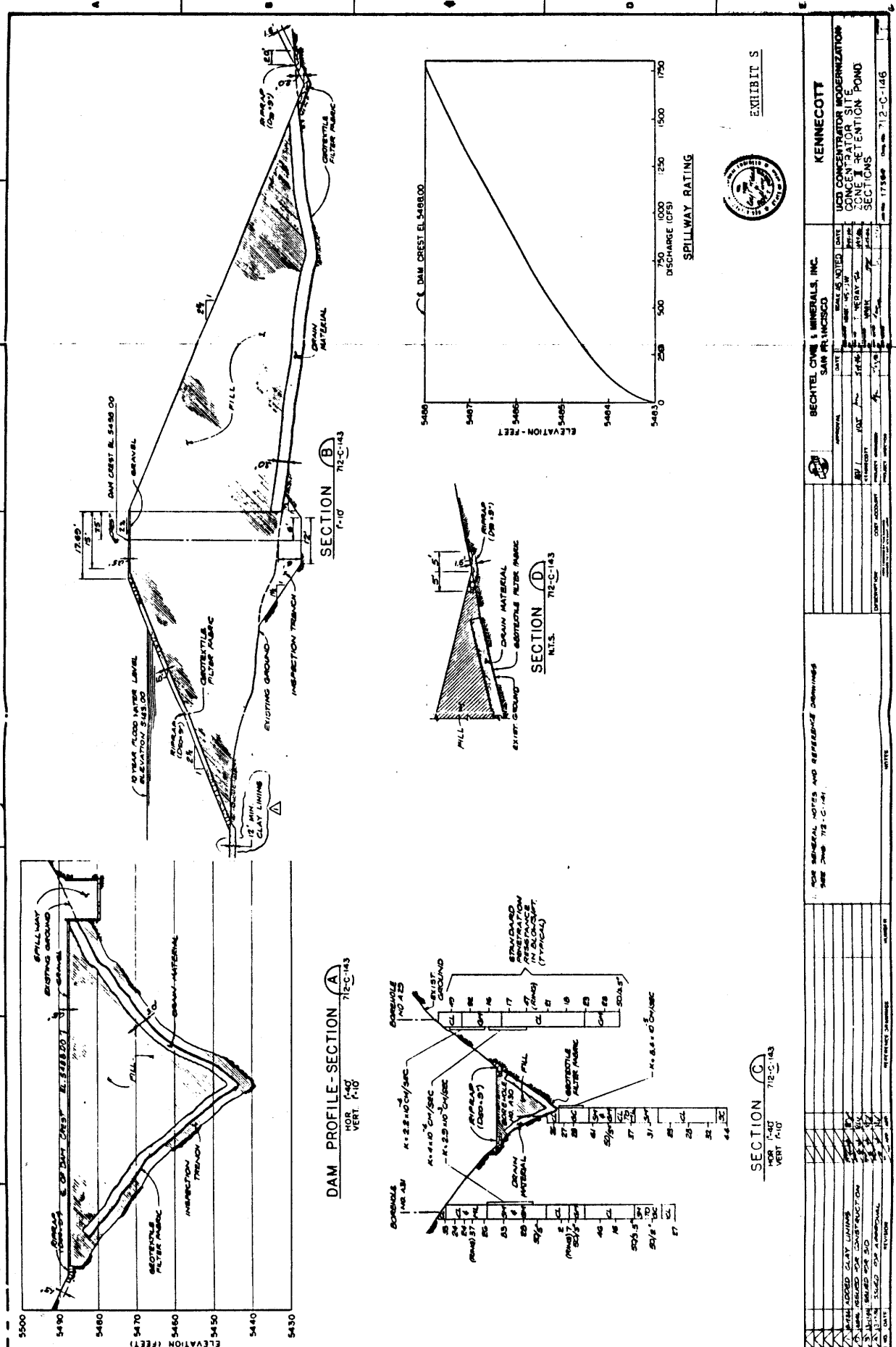

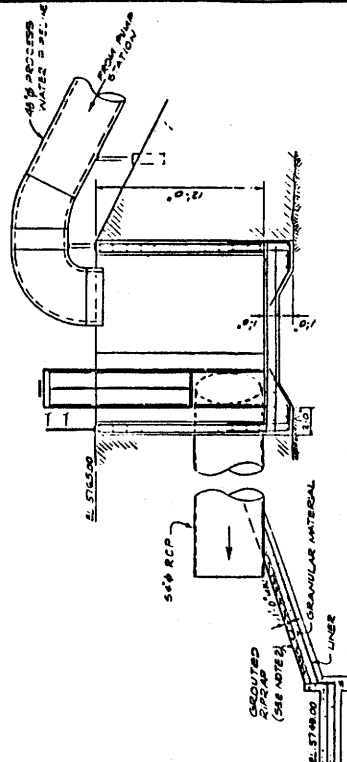


EXHIBIT S

FOR MINERAL NOTES AND REFERENCE DRAWINGS SEE SHEET 712-C-146										KENNECOTT									
										BECHTEL CIVIL & MINERALS, INC.									
										SAN FRANCISCO									
DATE										DATE									
1/15/00										1/15/00									
BY										BY									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00										1/15/00									
1/15/00																			

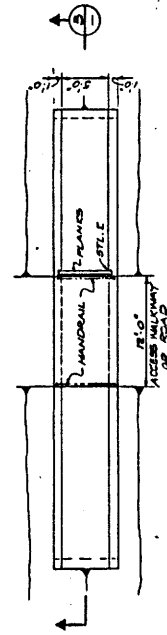


340'

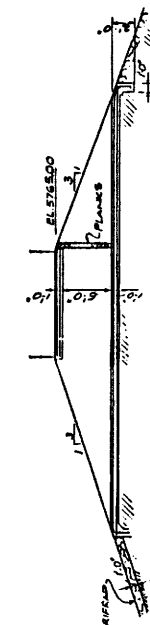
KEY PLAN

INLET BOX

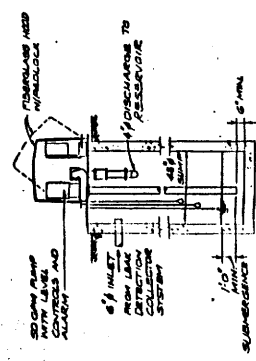
SECTION A
I



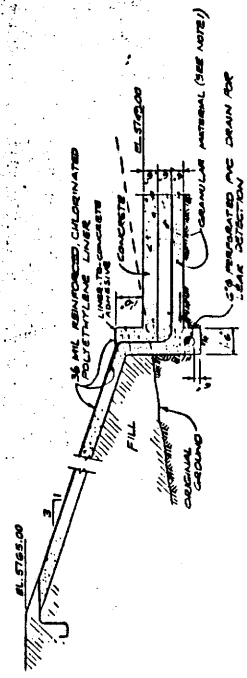
BALANCING CHANNEL



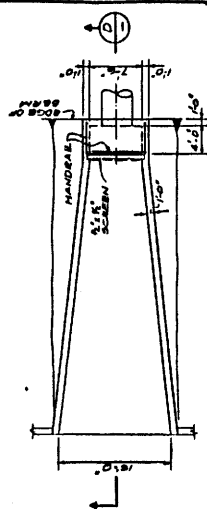
SECTION B



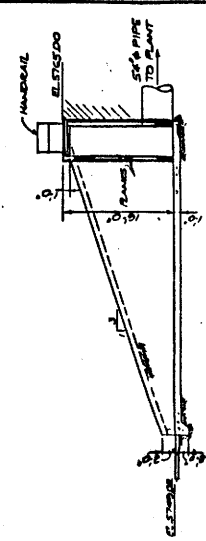
LEAK DETECTION SYSTEM



SECTION



OUTLET STRUCTURE



SECTION DI

[illegible]

PLAN

SECTION

SECTION 8

DATE	DESCRIPTION	DEBIT	CREDIT	BALANCE	TYPE
11/1/78	11/1/78	100.00		100.00	11
11/2/78	11/2/78	100.00		200.00	11
11/3/78	11/3/78	100.00		300.00	11
11/4/78	11/4/78	100.00		400.00	11
11/5/78	11/5/78	100.00		500.00	11
11/6/78	11/6/78	100.00		600.00	11
11/7/78	11/7/78	100.00		700.00	11
11/8/78	11/8/78	100.00		800.00	11
11/9/78	11/9/78	100.00		900.00	11
11/10/78	11/10/78	100.00		1000.00	11
11/11/78	11/11/78	100.00		1100.00	11
11/12/78	11/12/78	100.00		1200.00	11
11/13/78	11/13/78	100.00		1300.00	11
11/14/78	11/14/78	100.00		1400.00	11
11/15/78	11/15/78	100.00		1500.00	11
11/16/78	11/16/78	100.00		1600.00	11
11/17/78	11/17/78	100.00		1700.00	11
11/18/78	11/18/78	100.00		1800.00	11
11/19/78	11/19/78	100.00		1900.00	11
11/20/78	11/20/78	100.00		2000.00	11
11/21/78	11/21/78	100.00		2100.00	11
11/22/78	11/22/78	100.00		2200.00	11
11/23/78	11/23/78	100.00		2300.00	11
11/24/78	11/24/78	100.00		2400.00	11
11/25/78	11/25/78	100.00		2500.00	11
11/26/78	11/26/78	100.00		2600.00	11
11/27/78	11/27/78	100.00		2700.00	11
11/28/78	11/28/78	100.00		2800.00	11
11/29/78	11/29/78	100.00		2900.00	11
11/30/78	11/30/78	100.00		3000.00	11
12/1/78	12/1/78	100.00		3100.00	11
12/2/78	12/2/78	100.00		3200.00	11
12/3/78	12/3/78	100.00		3300.00	11
12/4/78	12/4/78	100.00		3400.00	11
12/5/78	12/5/78	100.00		3500.00	11
12/6/78	12/6/78	100.00		3600.00	11
12/7/78	12/7/78	100.00		3700.00	11
12/8/78	12/8/78	100.00		3800.00	11
12/9/78	12/9/78	100.00		3900.00	11
12/10/78	12/10/78	100.00		4000.00	11
12/11/78	12/11/78	100.00		4100.00	11
12/12/78	12/12/78	100.00		4200.00	11
12/13/78	12/13/78	100.00		4300.00	11
12/14/78	12/14/78	100.00		4400.00	11
12/15/78	12/15/78	100.00		4500.00	11
12/16/78	12/16/78	100.00		4600.00	11
12/17/78	12/17/78	100.00		4700.00	11
12/18/78	12/18/78	100.00		4800.00	11
12/19/78	12/19/78	100.00		4900.00	11
12/20/78	12/20/78	100.00		5000.00	11
12/21/78	12/21/78	100.00		5100.00	11
12/22/78	12/22/78	100.00		5200.00	11
12/23/78	12/23/78	100.00		5300.00	11
12/24/78	12/24/78	100.00		5400.00	11
12/25/78	12/25/78	100.00		5500.00	11
12/26/78	12/26/78	100.00		5600.00	11
12/27/78	12/27/78	100.00		5700.00	11
12/28/78	12/28/78	100.00		5800.00	11
12/29/78	12/29/78	100.00		5900.00	11
12/30/78	12/30/78	100.00		6000.00	11
12/31/78	12/31/78	100.00		6100.00	11
1/1/79	1/1/79	100.00		6200.00	1



KEY PLAN

DROP BCX TYPE I
NTS

DROP BOX TYPE II
NTS

EXHIBIT 'A'

KENNECOTT

IL CIVIL & MINERALS, INC.
SAN FRANCISCO

KENNECOTT
UICD CONCENTRATOR MODERNIZATION
LOTATION FEED SYSTEM PIPELINE
DROP BOX DETAILS

--

IL CIVIL & MINERALS, INC.
SAN FRANCISCO



II

11

1. *Journal of the American Medical Association*, 1997; 278: 1039-1044.

--	--	--	--

© 2005 Blackwell Publishing Ltd, *Journal of Internal Medicine* 258: 105–112

111

1111

44

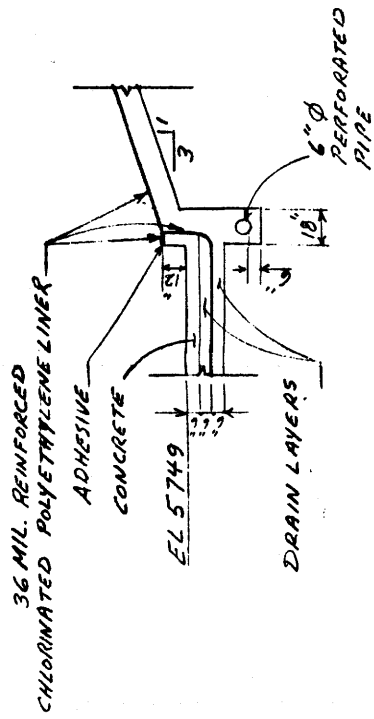
1111

1

--	--	--	--	--	--

140

1



DETAIL 1
1" = 5'

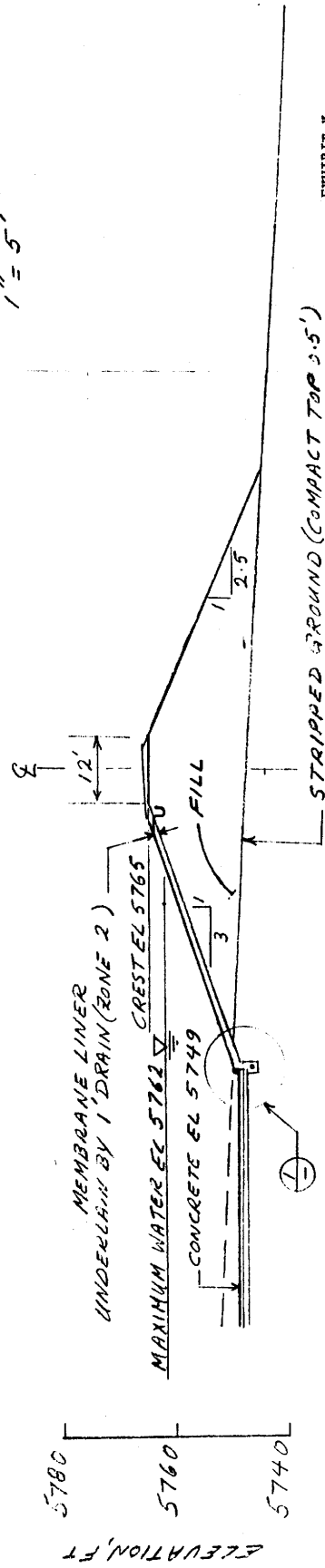


EXHIBIT X

PROCESS WATER RESERVOIR
LINER DETAIL

SECTION A-A
1" = 20'

NOTE: THE PERMEABILITY OF MATERIAL UNDERLYING THE MEMBRANE LINER AND DRAIN LAYER IN CUT AREAS IS IN THE RANGE OF 10^{-3} TO 10^{-4} CM/SEC

BECHTEL CIVIL & MINERALS, INC.

HYDROLOGICAL AND HYDRAULIC

DESIGN REPORT

17594-DC-006

FOR

RETENTION PONDS

FOR

UCD MODERNIZATION PROJECT - GRINDING PLANT

KENNECOTT

SALT LAKE CITY, UTAH

JOB NO. 17594

0	4-21-86	Issued for Construction	TH/RE	Joe (M)	WCH/RE	WCH/AGM
A	3-20-86	Issued for Client Approval	TH/RE	Joe (M)	WCH/RE	
Rev. No.	Date	Revisions	Supv. Eng.	Chief Eng.	Proj. Eng.	Client
APPROVALS						

HYDROLOGICAL AND HYDRAULIC

DESIGN REPORT

FOR

RETENTION PONDS

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION	1
1.1 SCOPE	1
1.2 DESIGN CONDITIONS	1
2.0 HYDROLOGY	1
2.1 DRAINAGE AREAS	1
2.2 RUNOFF VOLUME	2
2.3 PEAK FLOWS	2
2.4 FREEBOARD	5
3.0 SPILLWAY HYDRAULICS	6
3.1 DESIGN CONDITIONS	6
3.2 CREST STRUCTURE	6
3.3 SPILLWAY CHANNEL	7
REFERENCES	8

HYDROLOGICAL AND HYDRAULIC

DESIGN REPORT

FOR

RETENTION PONDS

1.0 INTRODUCTION

1.1 Scope

This design report establishes the criteria used for the hydrological and hydraulic design of the plantsite runoff retention ponds. The geotechnical design criteria and the results of the geotechnical studies are presented in 17594-DC-007, "Soils Design Report for Retention Ponds and Process Water Reservoir."

1.2 Design Conditions

The drainage scheme of the plantsite requires the retention of runoff from three zones. Inflow from the 10 year-24 hour rainfall event will be retained in ponds formed by earthfill embankment dams constructed on the natural drainage channel of each of these three zones. The ponds capacity will include a ten percent sedimentation allowance. Furthermore 7 acre-ft. of storage in Zone III retention pond will provide for emergency storage of one hour of flotation feed at the design flow rate in the event of an outage of the flotation feed pipeline. Retained runoff will be removed from the ponds by pumping to the Process Water Reservoir. A pump will be installed in each retention pond and will be sized such that the 10 year-24 hour runoff volume stored can be evacuated in 10 days or less. The pond spillways will pass the one-half Probable Maximum Flood (PMF) event with two feet of freeboard. The spillway channel riprap lining will pass the 100-year event without significant damage and the one-half PMF event without damage to the dam embankment or the spillway crest structure.

2.0 HYDROLOGY

2.1 Drainage Areas

The zone I pond will retain the runoff from 26.1 acres, including the future office and half the future maintenance shop and grinding area and the southern half

of the coarse ore stockpile. Zone II Pond will retain runoff from 12.8 acres, including the parking lot, Change House, and the south and east portions of the process area. Zone III pond will retain runoff from 73.4 acres, including the northern half of the coarse ore stockpile and the process area.

2.2 Runoff Volume

Runoff volume calculations are based on the 10 year-24 hour precipitation event. Rainfall data is based on National Oceanic and Atmospheric Administration's (NOAA) "Precipitation Frequency Atlas of the Western United States," Vol. 6, Utah, 1973.

The NOAA data were compared to rainfall data gathered by Kennecott at the Bingham Canyon Mine over the past 10 years. The largest 24-hour event measured at an elevation in the mine comparable to the concentrator site elevation was 2.6 inches which corresponds with NOAA value for a 10 year-24 hour precipitation at the project location. Table I summarizes the required retention pond volumes.

TABLE 1

Zone	Area Acres	Runoff Coef. C	24-hr. Rainfall Inches	Runoff Volume Acre-ft.	Retention * Pond Volume Acre-ft.
I	26.1	0.56	2.6	3.2	3.5
II	12.8	0.80	2.6	2.2	2.4
III	73.4	0.55	2.6	8.7	9.6 **

* Minimum volume retained below dam spillway crest elevation. Includes ten percent of runoff volume added for sedimentation allowance.

** Excludes 7.0 acre-ft. of storage for emergency dump of flotation feed pipeline.

2.3 Peak Flows

Peak flows for the 100-year and the Probable Maximum Flood (PMF) were calculated for the design of the retention pond spillways.

2.3.1 Probable Maximum Precipitation (PMP)

The U.S. National Weather Service Hydrometeorological Report No. 49 (Reference 1) was used to derive the local storm PMP for durations ranging from 15 minutes to 6 hours. An elevation reduction factor was applied to account for the height of the retention pond site above 5000 ft. An area reduction factor was not used because the three drainage areas are all less than one square mile. The results are summarized in Table 2. A five-minute PMP was extrapolated from these data.

TABLE 2

Probable Maximum Precipitation

<u>Duration</u> <u>(min)</u>	<u>Rainfall</u> <u>(inches)</u>
5	5.1
15	7.3
30	8.7
45	9.3
60	9.8
120	11.2
180	11.9
240	12.3
300	12.5
360	12.7

2.3.2 Probable Maximum Flood (PMF)

The U.S. Army Corps of Engineers HEC-1 computer program (Reference 2) was used to calculate a PMF hydrograph for each of the three retention ponds. A six hour storm event with an incremental precipitation sequence at five minute intervals was synthesized. Interception and infiltration were simulated by using the U.S. Soil Conservation Service (SCS) curve number method (Reference 3). The soils at the project site are classified as being part of the Hydrological Soil Group C (Reference 4). The hydrological condition for infiltration is fair, and the antecedent moisture condition is Class II. The SCS curve number for these conditions is 79 (Reference 3). The percentage of impervious area in each watershed

is based on the ratio of developed and undeveloped land within each zone. Basin response to excess precipitation was simulated by using the dimensionless SCS unit hydrograph. The results of the Probable Maximum Flood Calculations are summarized in Table 3.

The 100-year floods were calculated using the rational formula and the results are tabulated in Table 4.

TABLE 3

Probable Maximum Flood

Zone	Drainage Area (Acres)	Time of Concentration (min)	SCS Curve Number	Impervious Area (%)	Peak Flow (cfs)
I	26.1	12	79	55	760
II	12.8	11	79	95	410
III	73.4	17	79	50	1670

TABLE 4

100-Year Peak Flow

Zone	Drainage Area (Acres)	Runoff Coef. C	Peak Flow (cfs)
I	26.1	0.56	51
II	12.8	0.80	36
III	73.4	0.55	141

2.4 Freeboard

The minimum Freeboard for all three ponds will be 2 feet from dam crest elevation to maximum water surface when the spillways are discharging the design flood of 1/2 PMF. The allowance for minimum freeboard was based on the sum of calculated wind setup, wave runup and safety margin. In these calculations, the wind setup and the wave runup were determined for each pond using a design wind speed of 80 mph.

Wind set-up was determined by the Zuider Zee project formula (Reference 5). In all three ponds the setup heights were very small. The results are summarized in Table 5.

Wave runup calculations were based on U.S. Army Corps of Engineers method for riprapped earth embankments (Reference 6). The design runup height is 1.5 times the runup height that is associated with the significant wave height. The results of significant wave heights and design wave runup are summarized in Table 6 and 7.

TABLE 5

Wind Setup

Zone	Fetch (mi)	Average Depth (ft)	Setup (ft)
I	0.053	10	0.02
II	0.058	8	0.03
III	0.139	10	0.06

TABLE 6

Significant Wave Height

Zone	Effective Fetch (mi)	Significant Wave Height (ft)	Wave Length (ft)	Wave Steepness
I	0.023	0.62	7.0	0.089
II	0.021	0.59	6.6	0.089
III	0.051	0.90	10.9	0.083

TABLE 7

Runup

Zone	Runup Height Associated with Significant Wave Height	Design Runup Height
	(ft)	(ft)
I	0.54	0.81
II	0.51	0.77
III	0.80	1.20

3.0 SPILLWAY HYDRAULICS3.1 Design Conditions

The spillways were designed to pass the one-half PMF event with two feet of freeboard. Spillway capacities for the retention ponds are as follows:

Retention Dam	10 year-24 hour	Flood Event	
		100 year	1/2 PMF
Zone I	0	51	380
Zone II	0	36	205
Zone III	0	141	835

As shown above, the spillways were designed to contain the 10 year-24 hour storm without spilling.

The retention ponds were assumed full with water surface at lip of spillway at the time of the design storm. Since pond storage is small, no reduction in flow was taken for the volume related to spillway surcharge. Thus, the spillways were designed to pass the entire 1/2 PMF event without attenuation.

3.2 Crest Structure

Concrete ogee overflow spillways were selected for passing storm flows in excess of the 10 year-24 hour event. The following hydraulic criteria was used in the design of the ogee spillways for the Zones I, II and III retention ponds.

- o Approach Channel: flared entrance to minimize hydraulic losses, approach depth equal to twice the design head on the spillway crest.

- o Entrance Side Walls: edges rounded with a radius of $1/2$ time the design head.
- o Ogee Crest: crest elevation set at 10 year-24 hour flood pool. Vertical upstream face, top surface ellipse curvature; discharge coefficient at design flow equal to 4.0; spillway invert downstream of crest set a minimum of 1.7 times the design head below the maximum retention pond water level.
- o Rectangular Concrete Channel Below Ogee Crest: width equal to spillway crest, slope set to maintain supercritical flow.

3.3 Spillway Channel

A trapezoidal channel was selected to convey spillway flows from the concrete ogee overflow section to the existing stream channel. A protective system of riprap, gravel bedding and filter cloth was selected for lining the channel. The riprap lining was designed to pass the 100 year event without significant damage and to pass the $1/2$ PMF event without damage to the downstream embankment face or spillway crest structure. Protection of these facilities for the $1/2$ PMF event was provided by armoring the channel invert and bank adjacent to the dam embankment with large riprap.

The channel width was made equal to the length of the overflow crest in order to maintain shallow flows in the channels. Channel slopes were selected to maintain supercritical flow. The shallow flows over the riprap lining resulted in reduced velocities and reasonable riprap rock sizes.

Unit flows varied from 2.1 to 3.5 cfs/ft. for the 100 year event and 15.8 to 20.9 cfs/ft. for the $1/2$ PMF event. The rock sizes were determined from ICOLD Paper Q50.R9 (Reference 7). The results were compared against Isbash's Charts (Reference 8) and were found adequate. Riprap thickness was set at twice the diameter of the d_{50} stone. Gravel bedding and geotextile filter fabric were provided to prevent loss of subgrade material.

REFERENCES

1. U.S. National Weather Service, Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages, Hydrometeorological Report No. 49, 1977.
2. U.S. Army Corps of Engineers, HEC-1 Flood Hydrograph Package, Users Manual, 1981.
3. U.S. Soil Conservation Service, SCS National Engineering Handbook, Section 4, Hydrology, 1971.
4. U.S. Soil Conservation Service, Soil Survey of Salt Lake Area, Utah, 1974.
5. T. Saville, E. W. McClendon and A. L. Cochran, "Freeboard Allowances for Waves in Inland Reservoirs," Transactions of the ASCE, Paper No. 3465, Vol. 128, 1963.
6. U.S. Army Corps of Engineers, Wave Runup and Wind Setup on Reservoir Embankments, Engineering Technical Letter No. 1110-2-221, 29 November, 1976.
7. International Committee on Large Dams (ICOLD), Paper Q50.R9 (New Delhi, 1979), "Computation of Maximum Discharge of Overflow Rockfill Dams," by J. Knauss.
8. U.S. Army Corps of Engineers Paper #78-7, Practical Riprap Design, Fig. 3-8, Isbash's Charts "Velocity vs. Stone Diameter."
9. U.S. National Weather Service, Precipitation-Frequency Atlas of the Western United States, Volume VI - Utah, 1973.
10. U.S. Bureau of Reclamation, Design of Small Dams, 1974.
11. Sergeant, Hauskins and Beckwith, Preliminary Hydrological Investigation Report, Tailings Line Corridor, UCD Concentrator Modernization Project, 1984.